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Preliminary Yield Tables for Alaska's Interior Forests

Competent observers have estimated that the Interior of Alaska contains about 125 million acres which bear forest cover. These forests lie chiefly north of the Alaska Range, extending to the Arctic tundra. The best unburned forest areas in the Interior of Alaska occur on the lower slopes of the larger river valleys and contain an estimated 25 million acres of fairly dense white spruce and mixed stands.

As part of a study of the effect of fire on the ecological succession of Interior vegetation recently completed by Professor H. J. Lutz of Yale University and the Alaska Forest Research Center[1], 58 tenth-acre plots were measured in timber large enough to be of value in making a first appraisal of growth and yield for Interior Alaska stands. This study has shown the importance of the previously neglected Interior forests as a source of considerable wood material. The average per-acre stand volume of the 58 plots was 2,400 cubic feet and their average age was 123 years. Stands averaging 8 to 12 inches in diameter contained an average of 3,900 cubic feet or 15,500 board feet per acre. The growth rates obtained on the better sites are high enough to encourage sustained yield management.

Methods:

All trees six or more feet tall were tallied by species, diameter and height classes. Total heights of 6 to 8 dominant and codominant trees per plot were measured and increment borings taken.

These height measurements failed to give a dependable curve by plots. Hence a single height curve was constructed for all plots and species. The preliminary yield table (Table 1) is based on average stand diameters as described by Bruce.[2]

A table of standard heights based on stand diameter was prepared from the height measurements and is given in Table 2. This table cannot be used as Bruce did, to correct the stand volumes obtained from Table 1 because plot volumes were based on the average for all plots and species.

The increment core data were used to prepare Table 3, showing future diameter growth for trees based on average stand age. Using these growth values the basal area and average diameter of each plot were recomputed and a table of stand growth was prepared (Table 4). There being no data on mortality it was ignored and an uncertain amount of "false growth" is included.

1/ In cooperation with the Division of Forestry, Bureau of Land Management, U.S.D.I., Anchorage, Alaska.

2/ Bruce, Donald. A revised yield table for Douglas-fir. Issued by the Pac. Northwest Forest & Range Expt. Sta., Portland, Ore. Dec. 1948.

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Results:

The check of Table 1 against the basic data is as follows:

	Cubic volume 5" +	Cubic volume 7" +	No. trees per acre 2" +
Aggregate Difference	+ 1.0%	+ 1.0%	+ 0.3%
Standard Error of Estimate	8.6%	9.3%	35.5%

Table 3 provides a fairly accurate estimation of individual tree growth in these forests. Since these data are based on the wood increment an adjustment can be made for bark growth using Table 3a. Volume growth can be roughly estimated by using Tables 1 and 4. One of the sample plots may be used as an illustration.

Plot 18: Av. age - 120 years Av. dbh - 7.94 inches
Vol. 5" + - 6122 cu. ft. No. trees 2" dbh + - 1050

From Table 1. Estimated vol. 1050 X 5.73 = 6016 cu. ft; Normality - $\frac{1050}{534}$ = 1.97

From Table 4. Estimated diameter growth 0.51" in 10 years.
Increased av. stand diameter 8.45" at 10 years.
Volume 10 years hence - 973 X 7.0 = 6811 cu. ft.
10 year vol. growth = 795 cu. ft.
10 year annual increment = 79.5 cu. ft.

As mean annual increment = $\left(\frac{6811}{130} = 52 \text{ cu. ft.}\right)$ is less than the periodic annual increment, the stand has not reached a silvicultural rotation age.

A comparison of current cubic growth in inches of diameter and mean cubic growth per inch indicates in a rather unorthodox manner that the approximate silvicultural rotation age would be between 160 and 190 years, depending on site. A stand 175 years of age on an average site would have an occasional 20-inch tree and 30 percent of the trees would be 10 inches or larger. Sixty percent of the trees would be 7 inches or larger in diameter.

Growth prediction, using these tables, will be only an approximation until mortality and the trend toward normal stocking are known. More height, volume and growth data are needed.

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Table 1.--Average diameter yield table for Interior forests.

Av. dbh 1/ of stand	Normal No. 2/ trees per acre	Normal ht. trees of av. dbh	Volume in cu. ft. 3/ per tree in trees 5" +	in trees 7" +	Av. age of stand
3	1,325	20	0.16	0.09	26
4	1,100	27	0.50	0.20	54
5	880	37	1.10	0.80	78
6	710	45	2.20	2.00	97
7	600	51	3.80	3.50	118
8	530	55	5.85	5.60	138
9	450	60	8.40	8.10	158
10	370	64	11.25	11.15	174
11	300	67	14.25	14.15	188
12	270	71	16.50	16.40	201

1/ Trees over 1.5" weighted by basal area.

2/ Total stand ie., trees over 1.5" in dbh.

3/ Volume to 4" top in trees up to 10" and volume to merchantable height in 16-foot logs in trees over 10".

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Table 2.--Standard heights for well-stocked second-growth Interior forests based on average stand diameters.

Tree	Total height when average dbh of stand is:									
DBH	3	4	5	6	7	8	9	10	11	12
2	17	18	19	22						
3	20	22	24	27	28					
4	24	27	31	35	36	37				
5	26	33	37	40	41	42				
6	28	38	42	45	47	48	48	49	49	50
7	29	42	46	49	51	52	52	53	53	54
8	30	44	50	53	55	55	56	57	57	58
9	31	47	53	57	58	59	60	61	61	62
10	33	48	55	61	63	64	64	64	64	65
11		50	58	64	65	66	66	67	67	68
12		51	61	67	69	70	70	70	70	71
13		53	64	70	71	73	73	73	73	74
14		54	66	72	73	75	75	76	76	76
15			68	74	75	77	77	78	78	78
16			70	75	76	78	78	79	79	80
17				76	77	79	80	81	81	82
18				77	79	81	82	82	83	84
19				78	80	82	83	84	85	86
20				79	81	83	84	85	86	87
21								86	87	88
22								87	88	89

Table 3.--Estimated 10-year diameter growth of trees in Interior forests.

Tree DBH	Diameter growth when b. h. age of stand in years is: 20	40	60	80	100	120	140	160	180	200	220
2	.84	.35	.12								
3	1.18	.62	.35	.17	.09						
4	1.46	.87	.54	.35	.22	.13	.06				
5	1.66	1.05	.70	.50	.34	.23	.16	.13	.11	.10	.09
6	1.78	1.18	.84	.62	.45	.33	.27	.24	.22	.20	.19
7	1.85	1.26	.95	.71	.54	.42	.36	.34	.32	.30	.29
8	1.90	1.33	1.03	.79	.62	.50	.45	.43	.42	.40	.39
9	1.94	1.39	1.08	.85	.68	.57	.53	.51	.50	.48	.47
10	1.97	1.44	1.12	.90	.74	.63	.59	.57	.56	.55	.54
11	1.98	1.49	1.16	.94	.78	.68	.65	.63	.62	.61	.60
12		1.54	1.18	.98	.83	.74	.70	.69	.68	.67	.66
13			1.21	1.01	.87	.78	.74	.73	.72	.71	.71
14			1.23	1.04	.90	.83	.79	.78	.77	.76	.75
15				1.07	.94	.87	.83	.82	.81	.80	.80
16					.98	.92	.88	.87	.86	.85	.84
17						.96	.92	.91	.90	.89	.88
18						1.01	.96	.95	.94	.93	.92
19						1.05	1.01	.99	.98	.97	.96
20						1.09	1.05	1.03	1.02	1.01	1.00

Table 3a.--Bark growth factors. 1/

White spruce	1.065
Black spruce	1.065
Paper birch	1.075
Quaking aspen	1.096
Balsam poplar	1.096

1/ These factors correct wood growth to toal diameter growth to include bark growth. From Gevorkiantz and Olsen "An improved increment-core method for predicting growth of forest stands." Lake States For. Expt. Station Paper No. 12. July 1948.

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Table 4.--Estimated 10-year diameter growth of stands[1/] in Interior forests.

Av.DBH	Diameter growth when b. h. age of stand is:										
Stand	20	40	60	80	100	120	140	160	180	200	220
in.											
2	.82	.42	.33	.26							
3	.97	.51	.40	.33	.28	.23					
4		.62	.48	.40	.34	.28	.23	.17	.11		
5		.74	.57	.47	.40	.34	.28	.22	.17		
6		.89	.68	.55	.47	.39	.33	.28	.22	.18	.14
7			.79	.64	.54	.45	.39	.34	.28	.25	.20
8				.74	.61	.51	.45	.40	.35	.31	.27
9					.68	.57	.51	.46	.41	.38	.34
10						.63	.57	.52	.48	.45	.42
11						.70	.64	.59	.55	.53	.50
12							.71	.66	.63	.61	.58

1/ Based on average individual tree growth obtained from increment borings. Does not include effect of mortality.

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